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Technical Memorandum

To: Bill Johnson, Minnesota Department of Natural Resources
From: Tina Pint and Jeré Mohr
Subject: Response to Cooperating Agency Comments Related to Peter Mitchell Pit – Version 3
Date: June 4, 2015
Project: NorthMet EIS (23690862.00)
c: Jennifer Saran, Poly Met Mining Inc.

This memorandum addresses comments and questions raised by the Cooperating Agencies related to the potential for groundwater flow from the proposed NorthMet pits north to the Peter Mitchell Pits (PMP) after closure of both mines.[1]

This memorandum focuses on two key points regarding the conceptual model for groundwater flow in bedrock at the NorthMet Mine Site:

1. Based on historic conditions at Peter Mitchell pits, regional information from taconite operations on the Mesabi Iron Range, and professional judgment, it was determined that future mine pits (NorthMet) or mine pits expansions (Peter Mitchell) should not cause significant drawdown in the bedrock units. That determination, in conjunction with the distance between the two mine sites, led to the conclusion that the conceptual model for the NorthMet Project environmental impact statement should not include the potential for groundwater flow north from the NorthMet pit to the PMP. Information on historic conditions at Peter Mitchell pit are discussed in Section 2.1 and Section 2.2, and other regional information is presented in Section 2.3.

2. The determination that groundwater is unlikely to flow from the NorthMet pit to the PMP is further supported by ongoing monitoring of water levels in bedrock at the proposed NorthMet mine site during different stages of mine pit development at Peter Mitchell (presented in Section 3.1), and the results from site-specific aquifer tests (presented in Section 3.2). Based on a review of recent aerial photographs and water appropriations permit pumping records, significant dewatering began in a portion of the Peter Mitchell pit complex near the NorthMet Mine Site in approximately 2003. Water elevation data from NorthMet bedrock wells indicates that this dewatering has not caused a drop in water levels in bedrock at the NorthMet mine site. This data strongly supports the conceptual model that future dewatering and long-term conditions at Peter Mitchell pit will not significantly affect groundwater flow directions at NorthMet.

[1] Closure of the NorthMet Mine is anticipated to occur in approximately 2040. Closure of the Northshore Mine is anticipated to occur in 2070.

Even though northerly groundwater flow is not reasonably foreseeable, PolyMet has committed to monitoring water levels in bedrock between the NorthMet Mine Site and Peter Mitchell during operations, reclamation, and long-term closure to confirm the conceptual model. Proposed monitoring locations are discussed in Section 4.0; details on specific monitoring requirements will be determined in permitting. A number of adaptive management options to prevent northerly flow of groundwater are available if future monitoring suggests such flow to the north could occur (see Section 4.0). A list of possible options are as follows:

- control the water level in the West Pit via pumping to insure gradients are inward
- maintain a groundwater mound between the PMP and NorthMet pits by injecting water via wells
- maintain a groundwater mound between the PMP and NorthMet pits by constructing an infiltration trench
- grout fractures in the NorthMet pits to minimize outflow

1.0 Background Data on Peter Mitchell Pits and NorthMet Pits

The information presented in this section provides background on the physical settings of the Peter Mitchell and NorthMet Pits. Large Figure 1 shows the Peter Mitchell Pit areas near the NorthMet project area. Large Figure 2 shows the long-term plan for the Peter Mitchell Pits. In this document, the names used for the Peter Mitchell Pit areas generally follow the naming used by Northshore Mining. Table 1 summarizes the estimated pit bottom and water surface elevations at the NorthMet and Peter Mitchell pits over time.

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Table 1 Mine Pit Elevations

Period	NorthMet Pit Elevations (feet MSL)				Peter Mitchell Pit Elevations (feet MSL)(1)			
	West Pit		East Pit		Area 003 West(2)		Area 003 East(2)	
	Ground Surface	Water Surface	Ground Surface	Water Surface	Ground Surface	Water Surface	Ground Surface	Water Surface
Existing	1600	--	1600	--	1530-1580(3)	1624	1530	1568
Maximum Extent of Mining	940	--	920	--	1360-1380(3)	--	1360	--
Long Term (post 2080)	940	1576	1589(4)	1592	1360-1380(3)	1500	1360	1500

(1) Reference (1)
(2) PMP Area 003 West and Area 003 East refer to areas identified in Large Figure 1
(3) PMP Area 003 West consists of two interconnected pit areas with different bottom elevations
(4) Top of East Pit backfill
-- Pit is dewatered

Geologic cross sections through the Peter Mitchell pits and the NorthMet pits, locations of which are shown on Large Figure 1, are detailed in Large Figure 3 and Large Figure 4. These cross-sections show both existing conditions and maximum extents of both the Peter Mitchell pits and the NorthMet pits. At their maximum extent, the Peter Mitchell pits will remain approximately 6,500-8,000 feet (1.2 – 1.5 miles) north of the NorthMet mine pits, and will be approximately 400 feet MSL shallower.

2.0 Data Used to Inform the Conceptual Model

2.1 Peter Mitchell Pit Historic Levels

Water levels in the Peter Mitchell pits are considered surface expressions of the water table in the vicinity of those pits. Information on historical water levels in the various Peter Mitchell pits were used to help inform expected conditions during future operations. Limited public information is available on the water levels within the Peter Mitchell pits. To estimate water levels in portions of the Peter Mitchell pits over time, a combination of aerial photography and topographic data sets (including contour data and LiDAR data) was used. Water levels were estimated for two portions of the Peter Mitchell pits, referred to herein as Area 003 West and Area 003 East (Large Figure 1). The results of this analysis are summarized in Table 2.

Table 2 Approximate Historic PMP Water Levels

Year	Data Sources Used	Approximate PMP Water Level (feet MSL)	
		Area 003 West	Area 003 East
1991	Aerial + 1996 contours(1) + LiDAR	1622	1623
1998	Aerial + 1996 contours(1) + LiDAR	1620	1620
2006	Aerial + 1996 contours(1) + LiDAR	1624	1602
2008	Aerial + 1996 contours(1) + LiDAR	1625	1582
2009	Aerial + 1996 contours(1) + LiDAR	1625	1570
2010	Aerial + LiDAR	1623	< 1568
2011	LiDAR data	1622	1568
2013	Aerial + LiDAR	1624	< 1568

(1) Contour interval for 1996 contours is 5 feet

Pumping records for the water appropriation permits associated with the Peter Mitchell pit were also assessed. There was no water appropriated from the Area 003 West pits since at least 1988 (the first year electronic water use data is available). Since 2003, water has been appropriated from the Area 003 East pits (excluding 2005) at a nearly constant level (reported water usage obtained for Water Appropriation Permit 1982-2097 – 3 from http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html). This is consistent with the drop in water level observed in the aerial photos between 1998 and 2006.

Since 1991, water levels in the Area 003 West pits have remained relatively constant. It is unclear from aerial photography whether a surface connection currently exists between the two pit areas within Area 003 West, but water levels between the two areas have remained similar. Water levels in the Area 003 East pits have decreased since the late 1990s to less than 1568 feet MSL (the lowest visible contour based on the 2011 LiDAR data) since 2010. If there were a substantial cone of depression associated with Area 003 East pit dewatering, it would be reasonable to expect at least some water level response in Area 003 West, since these two pits are separated by approximately 500 feet at their closest point. No water level response in Area 003 West is apparent.

These observations indicate that the hydraulic conductivity of the Biwabik Iron Formation in the vicinity of the Peter Mitchell pits is low enough to support the large observed pit stages differences noted above. Based on the fact that PMP pits as close as 500 feet show no significant hydraulic connectivity, it is reasonable to conclude that the dewatering and long term closure of the PMP is unlikely to cause lowering of groundwater elevations large distances from the PMP site.

Although the Biwabik Iron Formation is utilized by some Iron Range communities as a water supply, regional information indicates that the formation has relatively low hydraulic conductivity in the area of the Peter Mitchell pits. Reference (2) indicates that "The Biwabik Iron-Formation lies about 3 miles south of Babbitt, but it is not an important aquifer in this area. Highly permeable leached ore bodies are not present east of Mesaba because of the thermal metamorphism by the intrusives of the Duluth Gabbro Complex (Reference (3)). Consequently, the permeability of the iron-formation is low, and ground-water movement through the formation is confined to narrow joints and fractures.

2.2 Lakes near Peter Mitchell Pit

Two lakes are located less than one mile northwest of the Peter Mitchell pits and overlie the Biwabik Iron Formation (the same formation mined at Peter Mitchell): Iron Lake and Argo Lake. Increasing lake water levels observed at these lakes from 1946 to 1980 during mining at Peter Mitchell, combined with the lakes' likely connection to bedrock, strongly suggest that the impact of the Peter Mitchell pits on the bedrock groundwater levels is limited, even in close proximity to the pits.

Iron Lake is approximately 170 acres in size with water surface elevation of around 1760 feet MSL and a maximum depth of about 20 feet. The MGS bedrock elevation GIS dataset estimates the top of bedrock elevation below Iron Lake ranges from 1740 to 1760 feet MSL. The metadata associated with this dataset indicates that the bedrock elevations have an approximate vertical accuracy of +/- 20 feet (Reference (4)). As the maximum lake depth is 20 feet, portions of the lake bottom are likely exposed to bedrock. In addition, a geologic map of the area surrounding Iron Lake shows bedrock outcrops immediately adjacent to the lake along several areas of the shoreline (Reference (5 p. Plate XVI)).

Argo Lake, located northeast of Iron Lake, is about 80 acres in size with a water surface elevation of about 1745 feet MSL. The MGS dataset estimates the top of bedrock below Argo Lake to be between 1700 and 1750 feet MSL. Although the bathymetry of Argo Lake is unknown, the bedrock elevation is approximately equal to the ground elevation along the northwest side of the lake and the regional bedrock map indicates bedrock outcrops along the northern and northeastern shorelines of the lake (Reference (6)), suggesting that at least some portion of the lake bottom is likely connected to bedrock.

Water level data are available for Iron and Argo Lakes from 1946 to 1980. Mining activities at Peter Mitchell commenced in the mid- to late 1950s and have been ongoing since that time. During that time, water levels in Iron Lake and Argo Lake have fluctuated within a 6.3 foot range and a 7.1 foot range, respectively (Figure 1). These ranges are relatively small for lakes without controlled outlets in a region with a net precipitation of approximately 11 inches per year.

Over the 30 year period from 1950 to 1980, the water level in both lakes has gradually increased by 2 to 3 feet. Based on 2011 LiDAR data, the elevation of Iron Lake (1760.2 feet) is 4 feet greater than observed in

1946. The estimated 2011 elevation of Argo Lake is 1745.1 feet, although the relative change from 1946 is unknown due to the use of a local datum from 1946 through 1980. The increase in water levels over time is likely due to the regional net precipitation of approximately 10+ inches and the fact that the lakes are landlocked. The gradual increases in lake water levels at elevations well above those of the nearby Peter Mitchell pits suggest that the nearby dewatering activities in the pits have not had a significant effect on the stages of the lakes. As with the observations of pit stage variations at PMP, the information on Iron Lake and Argo Lake indicates that the dewatering and closure of the PMP will not cause lowering of groundwater elevations at distances of less than one mile from the PMP site.

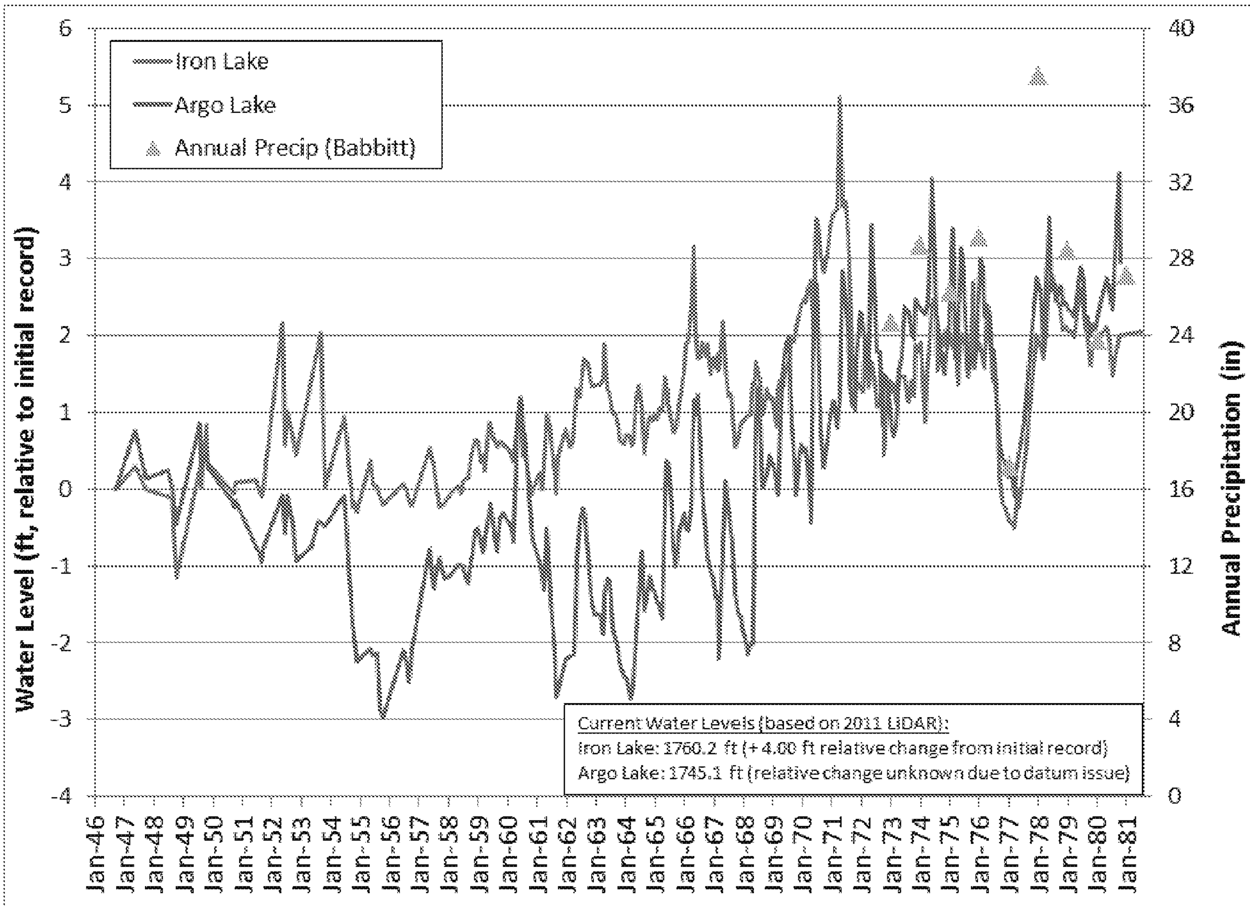
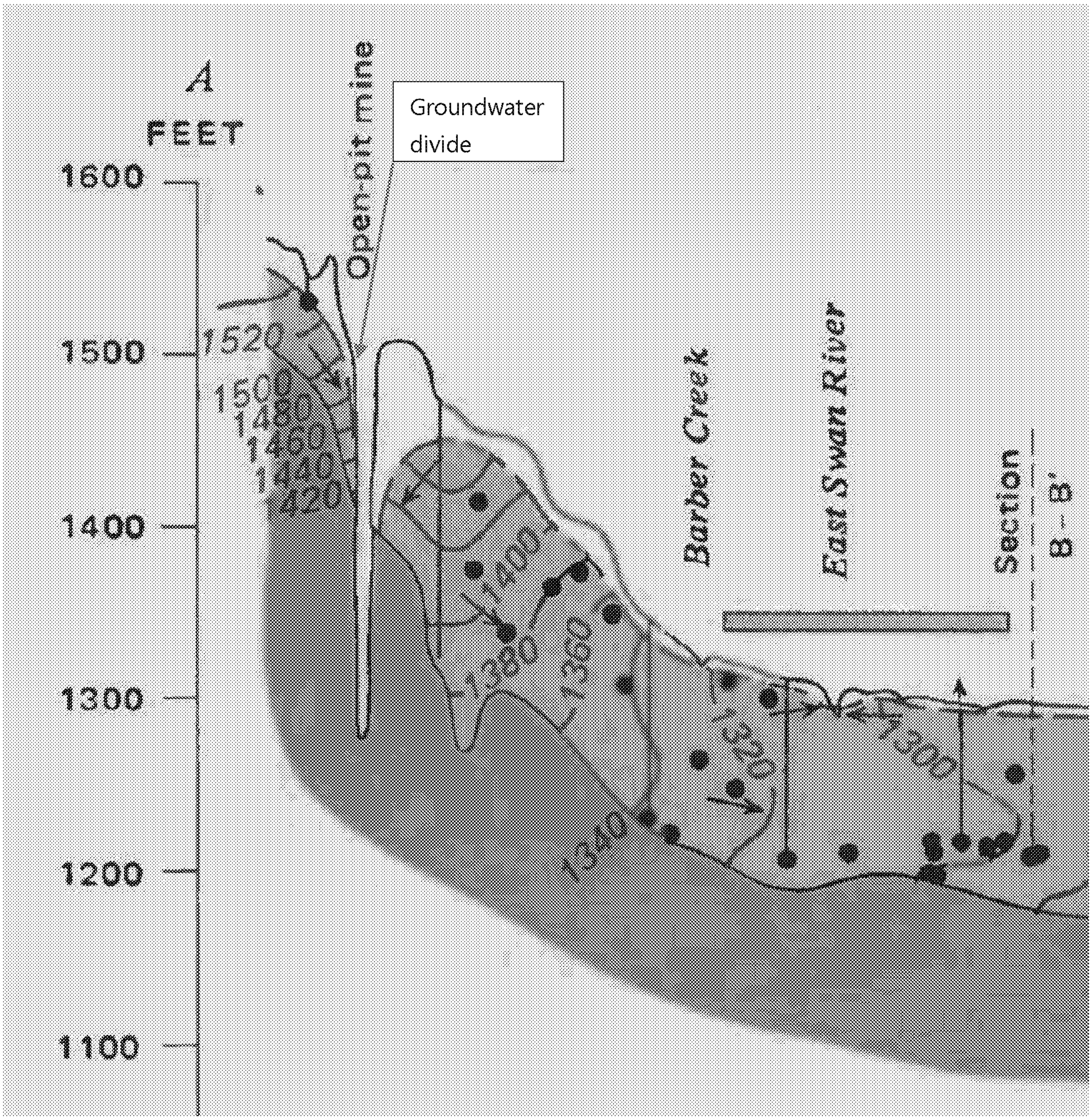


Figure 1 Historical Water Levels in Iron Lake and Argo Lake and Annual Precipitation

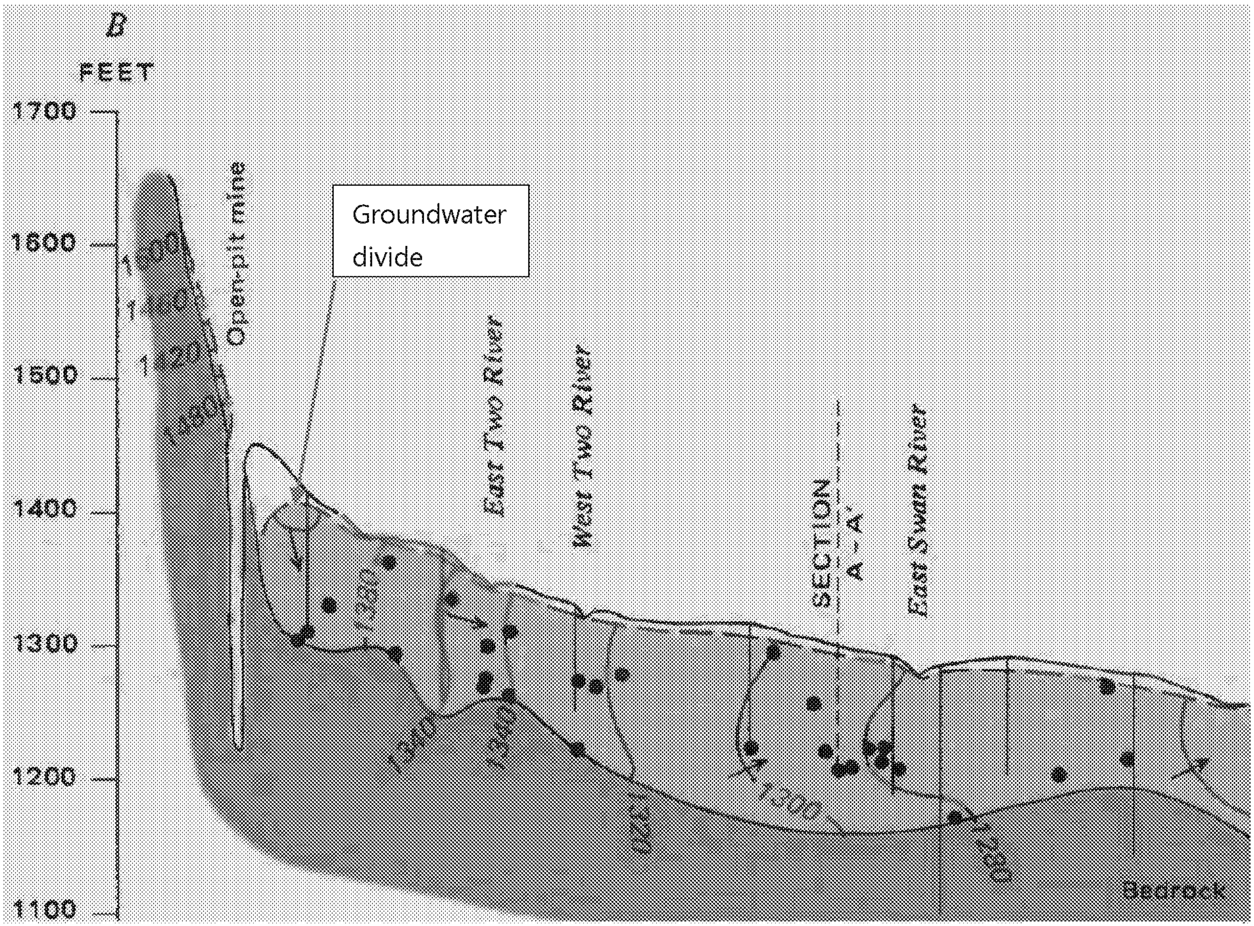
2.3 Regional Data from the Mesabi Iron Range

Historic evidence from the PMP and other open pits on the Iron Range further supports the conclusion that groundwater flow between the PMP and the NorthMet pits is unlikely, and that it is reasonable to expect that a groundwater mound between the two pits will be maintained. While local variability is expected, the geologic setting and characteristics of the sites discussed below are sufficiently similar to the area near NorthMet and PMP that the findings of these studies are useful in informing the expected groundwater flow directions in the area between NorthMet and PMP. Although bedrock water level data are limited, experience with open pit mining on the Iron Range has shown that the impacts from dewatering pits are realized locally, or within close proximity (within approximately 1500 feet) to the pits. For example, Figure 2 and Figure 3 show groundwater divides are inferred in the surficial aquifer within close proximity to open mine pits located near Chisholm and Eveleth (Reference (7)).



From Cross-section A-A' of Reference (7). *The portion shown has a length of approximately 17 miles*

Figure 2 Portion of a Cross Section Showing Hydraulic Head Contours in the Drift Aquifer Adjacent to an Open-pit Mine



From Cross-Section B-B′ of Reference (7). *The portion shown has a length of approximately 22 miles*

Figure 3 Portion of a Cross Section Showing Hydraulic Head Contours in the Drift Aquifer Adjacent to an Open-pit Mine

A hydrologic assessment in the Hibbing area showed similar results. Reference (8)indicates that in the Hibbing area, the groundwater divide in the surficial aquifer north of the mined areas still coincided with topographic divides. South of the mined areas, the groundwater divide in the surficial aquifer was estimated to be located within a few hundred to approximately 2000 feet of the mine pits and to range in elevation from approximately 1520 to greater than 1460 feet MSL adjacent to pits in which the water levels ranged from 1100 to 1175 feet MSL.

The East Range Hydrology Study focused on taconite mine pits in the Hoyt Lakes area and concluded that groundwater inflow to the pits was predominantly from surficial sources (Reference (9)). In addition, regarding refilling of mine pits following dewatering, the authors concluded that substantial groundwater outflow will not occur until the pit stage exceeds the lowest down-gradient water table elevation in the adjacent surficial deposits. These two observations support the concept that flow to a large pit with a low stage such as the existing and future Peter Mitchell pit would likely produce some water from seepage from the surficial deposits (limited by desaturation in the vicinity of the pit), and minimal groundwater flow from the bedrock, limited by the reduced saturated thickness in the vicinity of the pit. At Peter Mitchell, groundwater flow would be further limited by the lower hydraulic conductivity of the rock types that exist between the PMP and the NorthMet site.

The examples described above show that the hydrologic impacts from pit dewatering on the Iron Range are realized locally, or within close proximity to the pits. Because of this, it is reasonable to conclude that neither dewatering at the Peter Mitchell pits, nor the long-term closure plan for the pit, will have hydrologic impacts at the site of the future NorthMet pit.

2.4 Conclusion

All of the information above was known and available when the Co-leads developed the conceptual model for the PolyMet project. In summary: (1) Observations of water levels in the PMP show that hydraulic conductivity of the Biwabik Iron Formation in the vicinity of the Peter Mitchell pits is low, to the point that even pits as close as 500 feet do not show significant hydraulic connectivity. (2) Increasing water levels at two lakes less than one mile from the PMP—during active mining at the PMP—further demonstrate low groundwater connectivity. (3) Historic data shows that hydrologic impacts from pit dewatering are realized only within close proximity to the pits. For all of these reasons, it was reasonable to conclude as part of the PolyMet project conceptual model that groundwater would not flow north from the PolyMet pit to the PMP. Accordingly, it was not necessary to evaluate changing PMP levels in the Mine Site MODFLOW model that was used to perform certain impacts analyses for the NorthMet Mine Site.

3.0 Validation of the Conceptual Model

3.1 Site Groundwater Elevation Data

Water levels in NorthMet bedrock wells do not show a response to dewatering activities at Peter Mitchell. Water levels have been measured in five bedrock observation wells from 2007 to present. Wells OB-1 and OB-2 (shown on Large Figure 1) are completed in the Duluth Complex, while the remaining three wells are completed in the Virginia Formation. All five wells are 100 feet deep. Figure 4 shows groundwater elevation trends in these five wells compared with pit stages in the Peter Mitchell East Pit. The lack of response in the observation wells during a period of dewatering at the Peter Mitchell East Pit provides recent, direct evidence to support the conclusion that water levels in the PMPs do not have an effect on bedrock water levels at the NorthMet site.

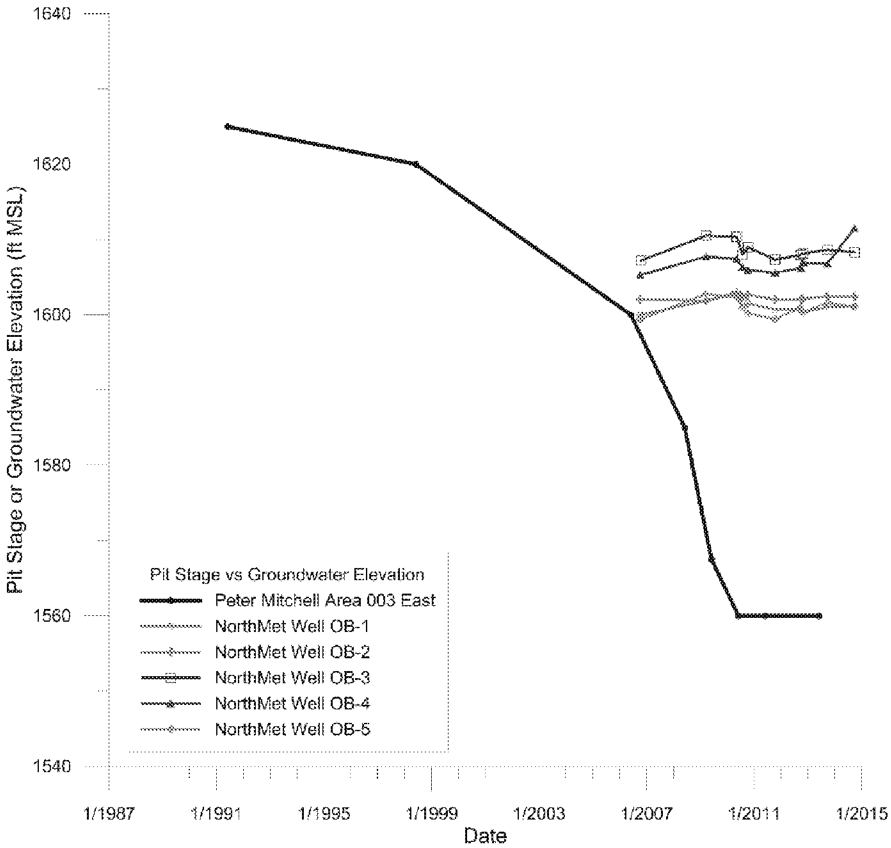


Figure 4 Plots of Groundwater Elevations in Bedrock Wells at the PolyMet Site and Stage in the Peter Mitchell East Pit

3.2 NorthMet Site-Specific Aquifer Testing

Pumping tests were completed at the Mine Site during the Phase II and Phase III Hydrogeologic Investigations conducted in 2005 and 2006 (Reference (10), Reference (11)). During the Phase II Hydrogeologic Investigation, tests were completed in four pumping wells (P-1 through P-4) completed in the Virginia formation, and water levels were monitored in bedrock observation wells (Ob-1 through Ob-5 and a preexisting water supply well). With the exception of Ob-2, which was installed in the Duluth Complex, all the observations wells were completed in the Virginia Formation. Pumping test durations ranged from 35 to 96 hours. During the Phase III Hydrogeologic Investigation, a 30-day pumping test was conducted in well P-2. The majority of the observation wells during this test were installed in the wetland deposits in the wetland north of P-2; however, water levels were also monitored in Ob-2.

The observed drawdowns in the pumping wells and observation wells during the pumping tests are summarized in Table 3 and shown on Large Figure 5. They indicate minimal propagation of drawdown within the bedrock due to its low transmissivity. For example, drawdown at wells P-1, P-2, and P-4 on the order of tens to hundreds of feet resulted in little to no observed drawdown in bedrock observation wells within a few hundred feet of the pumping wells. Drawdown in observation wells near P-3 was somewhat higher than other locations but, at most, was approximately half the maximum drawdown at the pumping well at a distance of 108 feet from the pumping well.

Hydraulic conductivity estimates from the Phase II pumping tests ranged from 0.0024 feet/day to 1 foot/day, with a geometric mean value of 0.17 feet/day. The low hydraulic conductivity of the Virginia Formation is expected to reduce the propagation of drawdown away from the PMP as the influence of the low stage in the pit spreads south at similar elevations to the pit walls. In addition, as the influence of groundwater inflow to the PMP spreads down-dip in the Biwabik Iron Formation, the high resistance to vertical flow through the Virginia Formation (because the Virginia Formation is a metasedimentary unit that likely have some degree of horizontal stratification) is expected to limit the influence on shallower units.

The fact that aquifer tests at the NorthMet site show minimal drawdown at distances as close as 115 feet further bolsters the conceptual model that changes in PMP water levels—which occur at least 6,500 feet away from the future NorthMet pit—will not cause northerly groundwater flow.

Table 3 Summary of Aquifer Tests Performed at the NorthMet Site

Hydrogeologic Investigation	Pumping Well	Average Pumping Rate (gpm)	Pumping Duration	Observation Well	Observation Well Distance from Pumping Well, feet MSL	Pumping Well Maximum Drawdown, feet MSL	Observation Well Maximum Drawdown, feet MSL
Phase II Hydrogeologic Investigation	P-1	1.5	36 hr	Ob-1	310	324.10	<0.1
	P-2	28	36 hr	Ob-2	274	258.04	4.57
	P-3	40	96 hr	Ob-3	115	41.09	8.66
				Ob-3a	108	41.09	23.22
				Water Well	330	41.09	16.73
	P-4	39	35 hr	Ob-4	1370	36.90	<0.1
				Ob-5	245	36.90	<0.2
Phase III Hydrogeologic Investigation	P-2	22	30 days	Ob-2	274	221.71	4.85

4.0 Adaptive Water Management

For the reasons discussed above, the work done to support the FEIS appropriately analyzes the reasonably foreseeable effects of the NorthMet Project. Those reasonably foreseeable effects do not include groundwater flow to the north through bedrock, which is highly unlikely to occur. Thus, mitigation measures designed to address northerly groundwater flows are highly unlikely to be needed. NEPA does not require an EIS to analyze environmental effects or mitigation measures that are highly unlikely to occur—i.e., not reasonably foreseeable.

PolyMet remains committed to adaptive management of adverse effects, even those that are not reasonably foreseeable, including any northerly flows of groundwater from the NorthMet mine pit that might occur after closure. The proactive tools the company will use to continuously evaluate potential environmental impacts include intensive monitoring and adaptive management. Monitoring information will be analyzed and adaptive management will occur, as needed, along with associated mitigations, to prevent significant adverse effects. These tools have been used throughout the environmental review process, and will continue to be used in permitting, operations, reclamation and long-term closure.

Proposed bedrock monitoring locations north of the NorthMet mine pit are shown on Large Figure 6. Final details on the number and locations of wells will be determined in permitting. Eight wells are proposed for the area between the PolyMet NorthMet pits and the Peter Mitchell pits. Two of these (the eastern most and the one between the Category 1 waste rock stockpile and the West Pit) are existing wells. These eight wells will provide key data during operations on the water level in bedrock to help address the question of whether there is the potential for flow between the two mine sites. Four additional bedrock wells are proposed in the area south of the West Pit and the Category 2/3 Waste Rock stockpile for other permitting purposes.

If conditions observed in these wells are not as expected and a groundwater divide is not maintained between the PMP and NorthMet project areas when the PMP water levels are below NorthMet water levels, one or more of several potential adaptive management options could be implemented.

One option for adaptive management would be to manage the NorthMet pit water levels via pumping to keep the West Pit stage below 1,500 feet MSL. Keeping the pit level lower would result in more exposed wall rock and more load generation, but the water pumped from the West Pit is routed to the WWTF. Based on the current MODFLOW model predictive simulations, groundwater inflow to the West Pit at an elevation of 1,500 feet MSL is expected to be approximately 50 gpm, approximately 10 gpm greater than the expected groundwater inflow at the currently-planned long-term elevation of 1,579 feet MSL. Water levels in the East Pit need to be maintained near an elevation of 1,592 feet MSL so that the waste rock in the pit remains saturated. However, by maintaining a lower water level in the West Pit, water from the East

Pit would flow to the West Pit instead of to the north toward the Peter Mitchell Pit because the gradient between the East and West Pits would be much larger than the gradient between the East Pit and the PMP.

Another option for adaptive management would be to maintain a water level in bedrock north of the NorthMet mine pits that is higher than the long term water level planned for the pits (shown in Table 1) by artificial recharge. Water level control via infiltration or injection is a proven technology that has been used successfully on other project sites to mitigate hydrologic impacts associated with mine pit dewatering. Rubio and Fernandez (Reference (12)) presents a high level overview of the use of artificial recharge of groundwater in mining, and includes examples of mines that have successfully used infiltration and injection to minimize the effects of mine dewatering at copper, gold and iron mines across the globe. One example is at the Garzweiler Lignite Mines in Germany, where a combination of surface trenches and injection wells are used to maintain water levels in the various bedrock and surficial units in order to minimize impacts to nearby wetlands. Huxley et al. provides additional case studies on how recharge features have been successfully used to mitigate the impacts of quarry dewatering (Reference (13)). Here in Minnesota, Unimin Corporation conducted a pre-mining field test to evaluate a water level mitigation system to prevent mine dewatering drawdown from impacting calcareous fen wetlands near their Kasota mine in Le Sueur County, Minnesota (Reference (14)).

At NorthMet, an application of this concept for preventing flow to the north would be to construct an infiltration trench on the north side of the Category 1 Waste Rock Stockpile, extending east along the north side of the cut-off dike, and to the eastern extent of the East Pit. This water filled trench would extend to bedrock and could have water levels maintained using a combination of stormwater runoff from the covered Category 1 Waste Rock stockpile and treated water from the Wastewater Treatment Facility (WWTF). If the water supply from these sources is inadequate to maintain water levels in the trench, se other water sources such as treated water from the Wastewater Treatment Plant (WWTP) could be used as a supplement. High water levels could also be maintained by use of injection wells in place of, or to supplement, the infiltration trench. These options could prevent northerly flow from the NorthMet mine pits if needed.

In addition, the Conceptual Plan for Bedrock Groundwater Flow Mitigation (Reference (15)) that PolyMet has outlined could also be used to minimize the potential for flow out of the NorthMet mine pits after closure. Use of grout to control water at mine site pits is a widely used and proven mitigation measure. At the NorthMet Mine Site, if appreciable bedrock flow into the pits occurs, it will be readily apparent as the pits are deepened during mining. Grouting those features (fractures, faults) down to the projected maximum depth of the final North Shore pit before the NorthMet pit is flooded is a potential application of the grouting plan that would prevent northerly flows from the site.

PolyMet will continue to refine and develop new monitoring and mitigation plans under its permit to mine. PolyMet fully expects that the permit to mine would include enforceable conditions regarding the monitoring and mitigation of northerly groundwater flow, even though such an effect is highly unlikely to occur. PolyMet would also be responsible under all of its permits to mitigate any impacts to other resources that might occur due to the continuous improvement of its closure plans.

5.0 References

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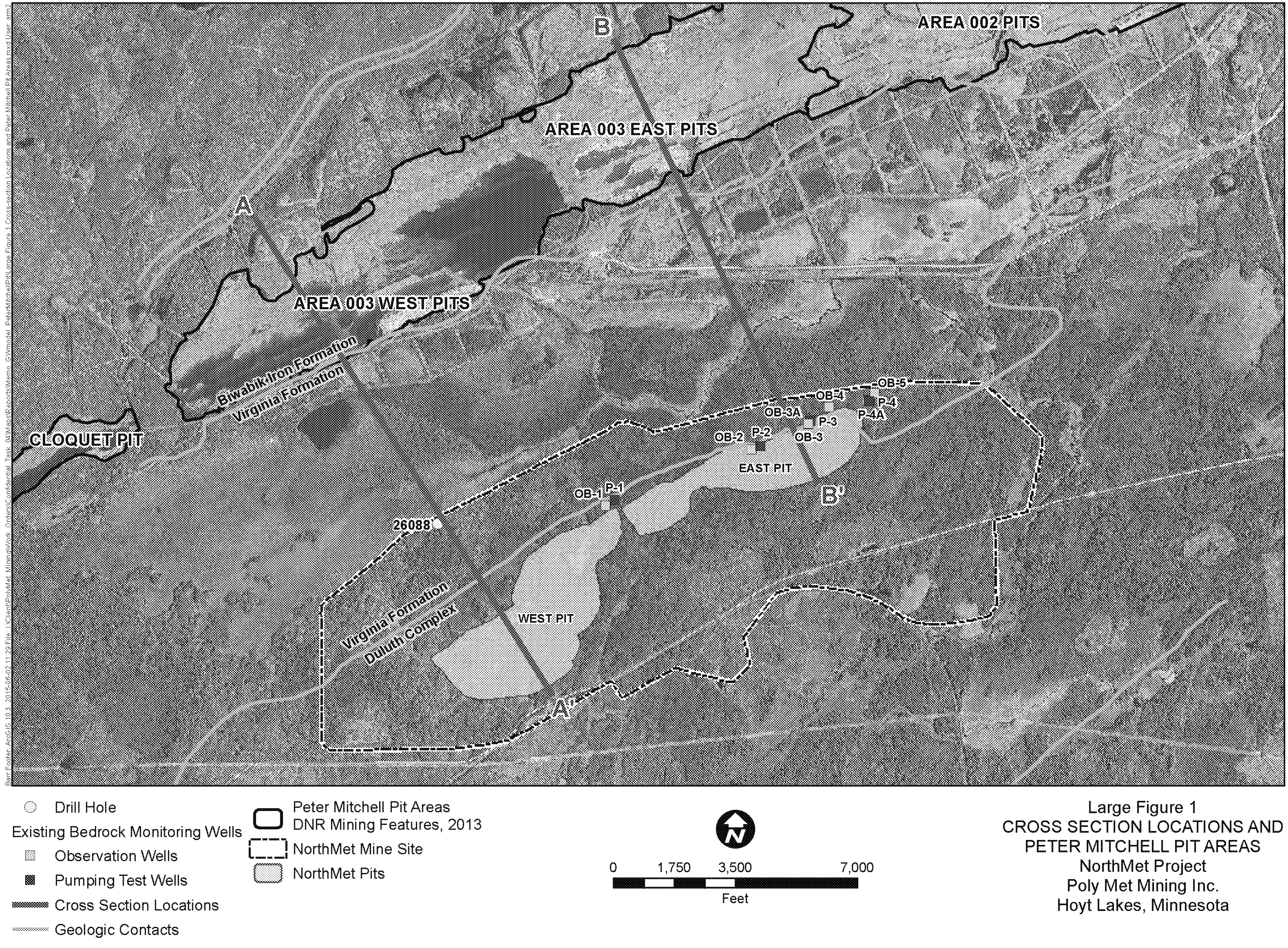
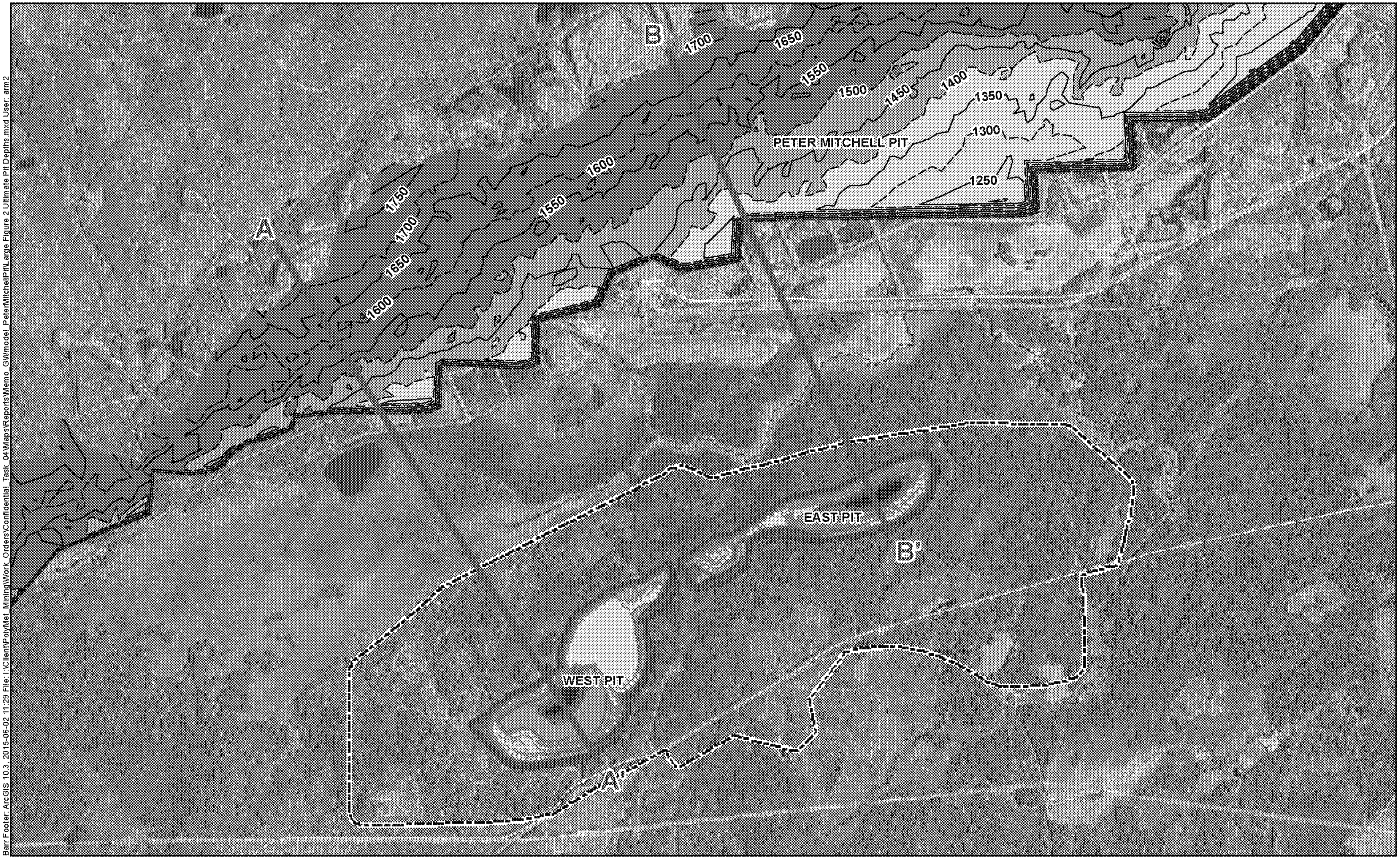


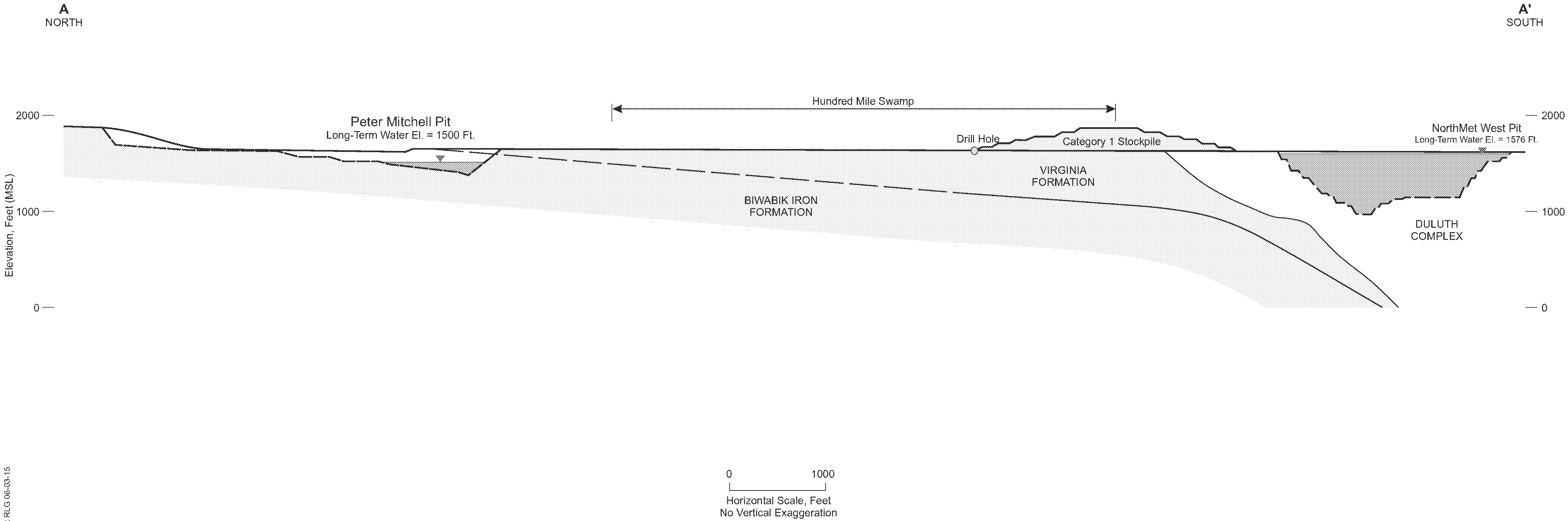
Large Figure 1
CROSS SECTION LOCATIONS AND PETER MITCHELL PIT AREAS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Cross Section Locations
NorthMet Mine Site
Future Topography (ft MSL)
920 - 1,000
1,000 - 1,100
1,100 - 1,200
1,200 - 1,300
1,300 - 1,400
1,400 - 1,500
1,500 - 2,000

0 1,750 3,500 7,000
Feet

Large Figure 2
ULTIMATE PIT ELEVATIONS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Geologic Contact
(Contacts are dashed in areas beyond the extent of PolyMet's geologic block model)

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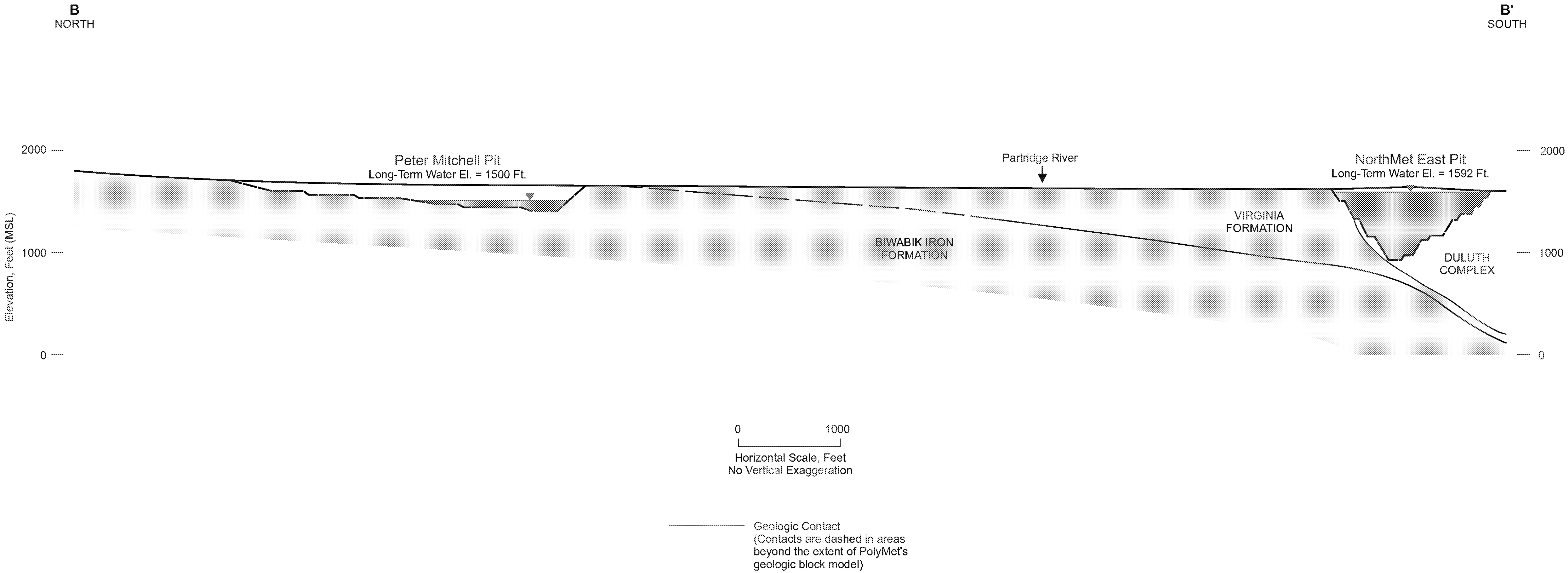
Large Figure 3

CROSS-SECTION A-A'
PolyMet Mining
Hoyt Lakes, MN

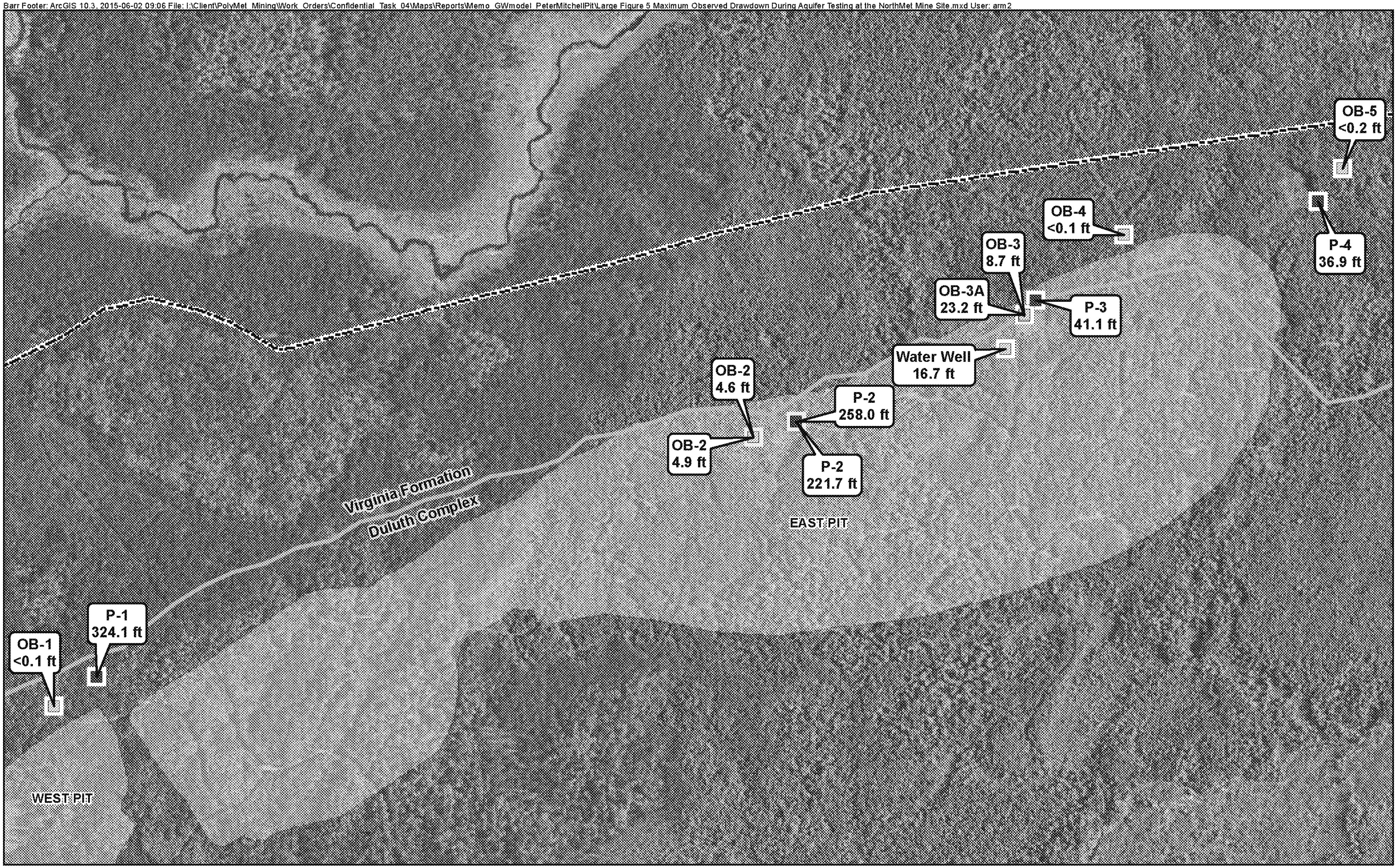


P:\Mpls\23 MN\69\2369862\WorkFiles\Figures_Graphics\2015 Figures_Graphics\Cross Section B-B'.CDR RLG 06-03-15

Large Figure 4

CROSS-SECTION B-B'
PolyMet Mining
Hoyt Lakes, MN

Barr Footer: ArcGIS 10.3, 2015-06-02 09:06 File: I:\Client\PolyMet_Mining\Work_Orders\Confidential_Task_04\Maps\Reports\Memo_GWmodel_PeterMitchellPit\Large Figure 5 Maximum Observed Drawdown During Aquifer Testing at the NorthMet Mine Site.mxd User: arm2



Existing Bedrock Monitoring Wells

Observation Wells

Pumping Wells

Aquifer Test Phase II

Aquifer Test Phase II and Phase III

Geologic Contacts

NorthMet Mine Site

NorthMet Pits

OB-1 <0.1 ft Well Name Phase II Maximum Drawdown

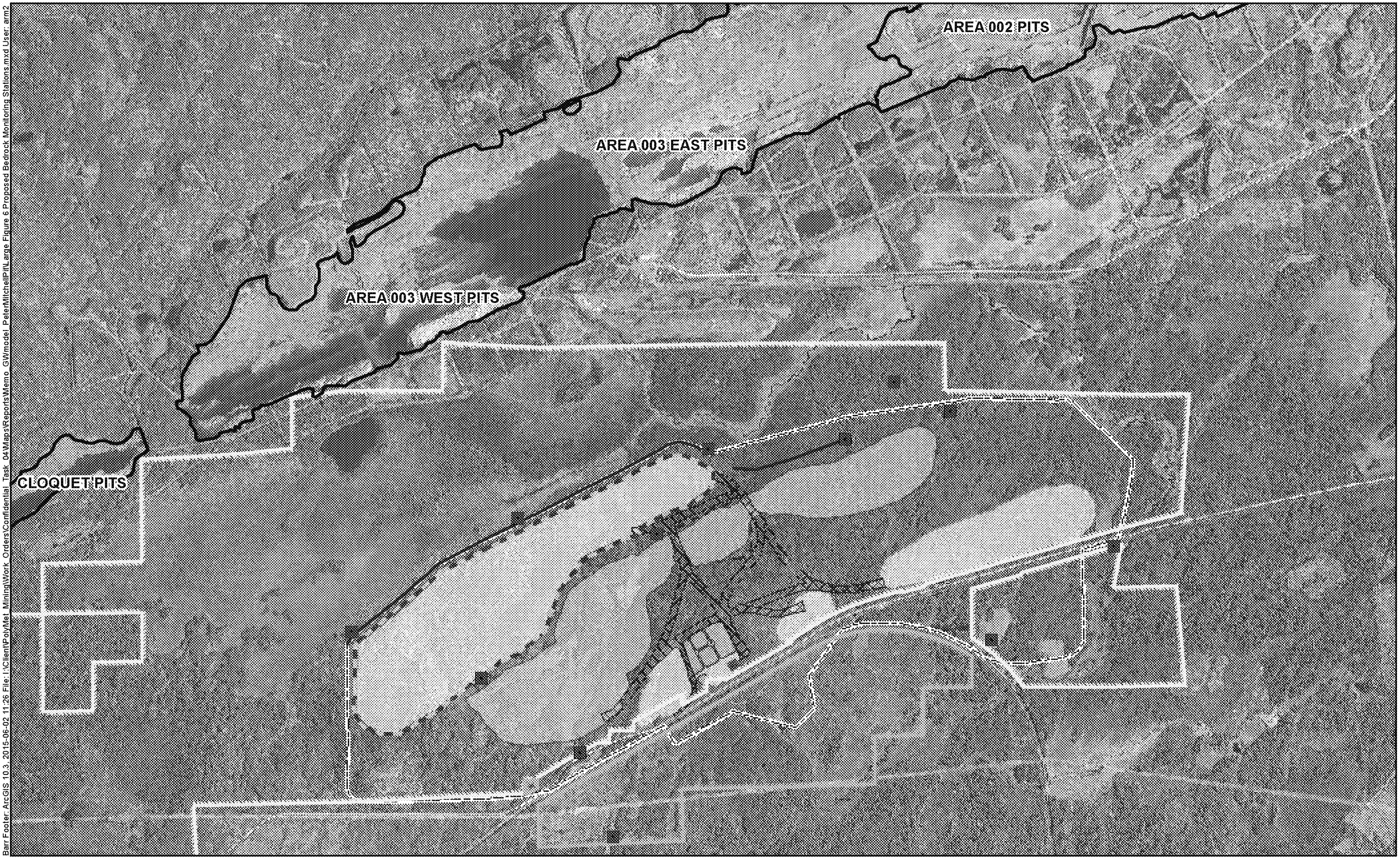
OB-1 <0.1 ft Well Name Phase III Maximum Drawdown

N

0 400 800 1,600

Feet

Large Figure 5
MAXIMUM OBSERVED DRAWDOWN DURING AQUIFER TESTING AT THE NORTHMET MINE SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



- Proposed Bedrock Monitoring Wells
- NorthMet Mine Site
- Peter Mitchell Pit Areas DNR Mining Features, 2013
- PolyMet Owned/Leased Area
- USFS Federal Land Exchange Parcel

Mine Layout - Year 11
- Mine Pit
- Active Stockpile
- Removed Stockpile
- Haul Roads
- Groundwater Containment System
- Perimeter Dike

0 1,750 3,500 7,000
Feet

Large Figure 6
PROPOSED BEDROCK MONITORING STATIONS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota